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(71) Applicant Champion Spark Plug Company, 900 Upton Avenue, Toledo, Ohio, United States of America
(72) Inventors James Thomas McManus, Eugene Stanley Paskiet
(74) Agents Marks & Clerk, 57—60, Lincoln's Inn Fields, London WC2A 3LS

(54) Preventing Corrosion of Zinc and Cadmium

(57) A method for treating chromated surfaces formed of zinc, cadmium or alloys thereof to improve corrosion inhibition comprising contacting the chromated surface with an aqueous silicate solution, the concentration of the silicate solution and the time of immersion being such as to increase corrosion resistance. Solutions containing from 0.5 to 75 grams per litre of sodium metasilicate, and their use to improve corrosion resistance, are disclosed.

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SPECIFICATION

Preventing Corrosion of Zinc and Cadmium

This invention is concerned with improvements in and relating to improving the corrosion resistance of zinc and/or cadmium surfaces.

Chromate treatments have long been used to increase the resistance to corrosion of surfaces formed of cadmium or zinc, or alloys thereof. The technique has been applied to parts fabricated entirely from zinc, cadmium and alloys thereof and to parts fabricated of other metals and thereafter coated with cadmium, zinc and their alloys, for example by electroplating.

Chromating is disclosed in United States Patent No. 2,035,380, and has been practised extensively for many years. The formation of a visible film, in addition to corrosion prevention, is discussed in that patent, which states that chromating can be accomplished in a bath containing at least 25 grams per litre of chromium trioxide, preferably added as sodium or potassium dichromate, and about 2 to 140 grams per litre of sulphuric acid or an equivalent amount of hydrochloric acid or nitric acid. Preferably, as indicated in the patent, the amount of acid should be from about 3 to about 86 grams per litre of sulphuric or an equivalent amount of one or the other indicated acids. Chromating is disclosed as involving only immersion of a part in a bath of the indicated composition, as requiring only a minute or so of immersion, and as being accompanied by the formation of a visible coating. In practice, fluorides, have also be added to chromating baths to produce so-called "clear chromate coatings" which are often slightly irridescent.

The present invention is based upon the discovery that the corrosion resistance of a chromated zinc or cadmium part can be significantly improved by immersion of that part in a solution, which can be relatively dilute, of a soluble silicate, e.g. an alkali metal silicate such as sodium metasilicate.

According to the invention, therefore, there is provided a process for treating a surface formed of zinc, cadmium and alloys thereof to inhibit corrosion, which method comprises chromating the surface and subsequently contacting the chromated surface with an aqueous silicate solution, the time of contact and the concentration of the silicate solution being such that the corrosion resistance of the chromated surface is increased.

Excellent results have been achieved by immersing chromated zinc-plated parts in aqueous solutions containing from 0.5 to 75 grams of sodium metasilicate per litre. Preferably, the solutions contain from about 1.5 to about 40 grams per litre of sodium metasilicate, most desirably from about 2.5 to 7.5 grams per litre. Excellent results have been achieved with solutions having a nominal sodium metasilicate content of about 4 grams per litre maintained at a temperature slightly above ambient, for example at about 45°C. Equivalent amounts of other silicates, for example sodium orthosilicate and sodium tetrasilicate can also be used, as can higher and lower temperatures, e.g., from the freezing point to the boiling point of the solution. Even the more expensive silicates such as potassium metasilicate and potassium tetrasilicate can also be used, but there is ordinarily no reason to incur the extra expense involved over the use of sodium silicates.

In order that the invention may be well understood the following examples are given by way of illustration only.

Example 1

Spark plug shells which had been zinc plated were rinsed and were chromated by immersion for approximately twenty seconds in a chromating bath prepared by dissolving a commercially available chromating composition in water at a concentration of 7.5 grams per litre and adding 42° Be nitric acid to pH 2. (The specific chromating composition employed was one which is commercially available under the trade designation "du Pont 140 S chromate conversion salt". When dissolved in water and acidified this salt forms chromic acid).

The chromated shells were then immersed for two minutes in a bath maintained at substantially 45°C and produced by dissolving sodium metasilicate in water at a concentration of 3.75 grams per litre. The treated spark plug shells were then rinsed and dried. Six of the dried shells were tested for resistance to white corrosion, using ASTM Test B 117. All six pieces showed only a trace of white corrosion product after having been subjected to the test conditions for twenty four hours. Three of the shells were subjected to the test conditions for an additional twenty four hours, after which they showed only slight formation of white corrosion products.

Comparative Example

For purposes of comparison, but not in accordance with the present invention, plated and rinsed spark plug shells were immersed for two minutes in a solution maintained at substantially 45°C and composed of 12 grams per litre of sodium metasilicate, and were thereafter rinsed and dried. The thus produced spark plug shells and spark plug shells which had been plated, rinsed and chromated as described in Example 1, but which had not been immersed in a sodium or other silicate solution, were subjected to ASTM Test B 117. All of the shells tested showed heavy deposits of white corrosion products after exposure for twenty four hours to the test conditions and after the second exposure for twenty four hours thereto.

Examples 2—9

Th procedure describ d in Exampl 1 was repeated sev ral times, with the exception that the concentration of the sodium metasilicate in the treating solution was vari d. The conc ntrations of sodium m tasilicate used for these procedures are given in the following Table; in all cases, the spark plug shells showed negligible white corrosion product when examined after both twenty four and forty-eight hours in accordance with ASTM test B117.

Example Number	*Sodium metasilicate content, gram(s) per litre*
2	0.75
3	1.9
4	7.5
5	10.8
6	15
7	18.8
8	26.5
9	33.8

It will be appreciated that various changes and modifications can be made from the procedures described in the foregoing Examples. For example, substantially the same results can be achieved by substituting sodium or potassium dichromate or CrO_3, for the chromating composition used in the procedure described in the Examples. In addition, such results have been achieved using silicate treating bath temperatures as low as 20°C, and immersion times as short as twenty seconds. Similarly, other chromates and dichromates can also be used, as can other silicates, including those specifically named above.

Claims

1. A method for treating a surface formed of zinc, cadmium and alloys thereof to inhibit corrosion, which method comprises chromating the surface and subsequently contacting the chromated surface with an aqueous silicate solution, the time of contact and the concentration of the silicate solution being such that the corrosion resistance of the chromated surface is increased.

2. A method as claimed in claim 1, in which the silicate solution is an aqueous solution containing from 0.5 to 75 grams per litre of sodium metasilicate.

3. A method as claimed in claim 1 substantially as hereinbefore described with reference to the examples.

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